Testing the Use of a Degree Day Model to Time Control of Grape Berry Moth (Year 2)

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Abstract:
The goal of this two-year study is to validate the use of a temperature-driven phenology model to time the application of insecticide for the control of grape berry moth (GBM), the key insect pest of grapes in the eastern United States. This multi-state project used replicated plots in vineyards in the Finger Lakes and Lake Erie Regions of New York, the Lake Erie Region of Pennsylvania and the Southwestern region of Michigan. This report details first year results from the Lake Erie region of New York. The use of a temperature driven Phenology model to time insecticide applications for grape berry moth resulted in a decrease in the number of applications from three to two when compared to the conventional timings provided by the Grape Berry Risk Assessment Protocol.

Background and Justification:
Grape Berry Moth (GBM) is the key insect pest of grapes in the eastern United States due to loss from the larval stage feeding directly on developing berries and also to loss associated with secondary rots that use the feeding wounds as an avenue for berry infection. The Grape Berry Moth Risk Assessment (GBMRA) Protocol developed by Hoffmann and Dennehy in the late 1980's has become the conventional means of grape berry moth management in New York State. (A complete description of the protocol can be found at: http://nysipm.cornell.edu/publications/grapeman/files/risk.pdf The GBMRA protocol worked well for many years. However, late season damage started to become a problem in the late 1990s and the GBMRA has proved to be less effective at determining the need for later season applications. With the first spray based on the timing of the bloom period, which is driven by temperature, the other spray timings are based on calendar dates with no correction in years that are much warmer or colder than average. The degree day (DD) requirements (use of daily high and low temperatures to determine heat accumulation) for development of each generation of grape berry moth has been investigated under laboratory conditions (Tobin et al. 2001, 2003). Based on these data we estimated that the number of degree-days for GBM to develop from eggs to egg-laying adult females is approximately 810 DD (^{0}F) using a base temperature of 47 ^{0}F. Using bloom date to start the collection of DD, a phenology model would predict the start of the second generation at 810 DD after bloom and the third generation at 1620 DD after bloom. This model has been tested at a few isolated sites but has not undergone evaluation under commercial vineyard conditions.

Objective:
Compare effectiveness of Grape berry moth control in multiple states when timing is based on a degree-day phenology model verses the calendar based Grape Berry Moth Risk Assessment Protocol.

Procedures:
Experiments will be conducted at vineyard sites each in New York (Finger Lakes and Lake Erie regions), Pennsylvania (Lake Erie region), and Michigan (Southwestern region), using Labrusca or hybrid vineyards with a high risk of GBM damage. At each site we will establish six-vine plots located at the vineyard edge where GBM pressure is greatest using a random block experimental design and 4-6 replicates per treatment. Treatments compared in this experiment will be: 1) treated with GBM insecticide following GBMRAP at 5-10 day post bloom, beginning of August, and end of August (commercial standard), 2) treated with GBM insecticide following GBM phenology model of Tobin et al. (2001) at 810 DD (°F) after biofix (bloom of the wild grape *V. riparia*) (predicted start of second generation), and 1620 DD (°F) after biofix (predicted start of third generation) and 3) untreated control.

Prior to harvest, 25 clusters in the three central vines of each plot will be collected and weighed to determine whether yield varies among treatments.

Results and Discussion:

A 'Concord' vineyard at the Cornell Lake Erie Research and Extension Laboratory (CLEREL) was used for this project and managed using commercial practices for vine nutrition, weed and disease management. Dormant pruning was accomplished to produce an average crop size across the experimental block. Five replications of six vines each were used for each treatment in a randomized complete block design. The end vines of each treatment replicate were used as a border vine (no count) to ensure there was no treatment overlap in vines where data was collected. Bloom in the commercial vineyard block was recorded on June 14, 2009 with wild grape bloom observed on or about June 7, 2009 (depending on location).

The first insecticide was applied in accordance with the GBMRA protocol in the GBMRA vines with the immediate post bloom application during the third week in July 2009. A second insecticide application was made to the GBMRA vines in the last week of June 2009. The wild grape bloom date of June 7 was used as the biofix to start recording Degree Days. Using 810 DD after the biofix as the timing of the first insecticide resulted in an application being called for on July 23 with a second application at 1620 GDD after biofix on August 27. A third insecticide application was applied to the GBMRA treatment during the first week in September for a total of three applications for the GBMRA blocks, two for the Phenology-based timing blocks and none for the control blocks.

As shown in Table 1, results of the first two years of this project were very encouraging in that the Phenology model provided similar grape berry moth control at harvest as the GBM RA protocol, with one less insecticide applied. An early spring frost in 2009 limited the amount of fruit in the Portland research block which may have had an impact on the results between treatments in 2009.

Table 1. GBM damage for 'Concord' vines not treated with insecticide, treated according to risk assessment protocols, or treated according to a temperature-driven phenology model in 2008 and 2009.

Treatment	October 7, 2008		September 25, 2009	
	Stings/ Cluster	%Cluster Infestation	Stings/ Cluster	%Cluster Infestation
Control	9.6	100	3.4	74
GBM RA	5.8	98	3.1	57
Phenology	5.4	90	3.9	70

The 2009 growing season in the Lake Erie Region was generally considered to be a light year for grape berry moth and other insect pests. The data from this project appears to back that up as the control treatment provided similar results to both the GBMRA and Phenology based models for grape berry moth management in 2009 while it had almost twice as much damage compared to either timing strategy in 2008. Plans are to continue to examine and refine the Phenology model and move it into larger vineyard blocks for further testing in 2010.

Project location:
Lake Erie Region of Western New York